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>
> The microcontroller program is composed of many interactive modules:
>   INIT    system initialization
>   MAIN    main program
>   AU_RG   autoranging loop
>   FTOV    internal timer interrupt service routine
>   CONV    a/d conversion of "rate" and "event filter" knobs
positions
>   ELAB    input data acquisition, computing, event filtering, 1 or 3
notes code generation
>   SCALA   musical notes codes computing (from 12 notes scale to 7
notes major scale)
>   TX_A    serial communication device transmission routine
>   N_ON    MIDI protocol "note on" string code assembler (calls TX_A
for tx) starts the play of a musical note
>   N_OFF   MIDI protocol "note off" string code assembler (calls TX_A
for tx) stop the play of a note
>   A_ANOFF generates a "all notes off" MIDI string code that
completely silences the sound generator
>   TABLE label points to the start address of a 12 bytes notes
codes conversion table (h B7F4)
>   TABLE is a 12 byte table with the 12 musical note code for the
conversion from the 12 notes scale to the major harmonic scale.
>Base address in eeprom = h b7f4
>Bytes    h  00 00 02 02 04 05 05 07 07 09 09 0a (not present in the
>listing, must be programmed in eeprom)

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>
>M68HC11 Absolute Assembler   Version 2.70C:MA03.ASC
>
>
>   1 A                                *****
>   2 A                                *   PROGRAMMA MA03 * Z.LAB 1997   *       BASE
B7F4
>   3 A                                *****                               REL.
> TEST      DEV
>   4 A                                *
>   5 A                                *
>   6 A                                ***** VARIABILI *****
>   7 A
>   8 A      0000      A_NTON      EQU      $00
;VALORE
> NOTE ON    CH A
>   9 A      0001      A_NTOFF    EQU      $01
;VALORE
> NOTE OFF   CH A
>  10 A      0002      A_NT1      EQU      $02
;CODA
> NOTE 1
>  11 A      0003      A_NT2      EQU      $03
;CODA
> NOTE 2
>  12 A      0005      A_VEL      EQU      $05
;VALORE
> VELOCITA' CH A (MIDI CH 00)
>  13 A      0006      A_INT      EQU      $06
;VALORE

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> INTORNO FILTRO EVENTI CH A
> 14 A      0007      A_ADC      EQU      $07
;VALORE
> DI INGRESSO CH A
> 15
> A      0009      A_SW      EQU      $09      ;IMMAGINE
SW CH A
> 16
> A      000C      A_MSB      EQU      $0C
;AUTORANGE DAC MSB
> 17
> A      000D      A_LSB      EQU      $0D
;AUTORANGE DAC LSB
> 18 A      000E      A_AR      EQU      $0E
;NUMERO
> INTERVENTI AU_RG PER SELEZIONE VELOCITA'
> 19 A      000F      A_ARFLG      EQU      $0F
;FLAG
> AU_RG CH A ON
> 20 A 0000
> 21 A      0020      RATE      EQU      $20
;FREQ.
> CAMPIONAMENTO ADC - SCANSIONE TEMPORALE
> 22 A      0022      TEMP      EQU      $22      ;VAR
> SUPPORTO PER SCALA
> 23 A      0023      AR_DEL      EQU      $23      ;E
$24 2
> BYTES RITARDO PER INCREM E DECREM RTNS
> 24 A 0000
> 25 A 0000
> 26 A      ** INDIRIZZI ASSOLUTI **
> 27 A
> 28 A      1003      PORTC      EQU      $1003
;PORTC
> 29
> A      B7F4      TABLE      EQU      $B7F4
;INDIRIZZO
> BASE TABELLA SCALA MAGGIORE
> 30 A 0000
> 31 A 0000
> 32 A      ** OFFSETS **
> 33 A
> 34 A      0003      IPORTC      EQU      $03
;PORTC
> OFFSET
> 35 A 0000
> 36 A 0000
> 37 A 0000
> 38 A      ***** PROGRAMMA PRINCIPALE *****
> 39 A
> 40 A      B600      ORG      $B600
> 41 A
> 42 A B600 867E      INIT      LDAA      #$7E
> 43 A B602 97DC      STAA      $DC
> 44 A B604 CCB724      LDD      #FTOV
;SETTA
> VETTORE INT OC2

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```

> 45 A B607 DDDD          STD          $00DD          ;PER
> SINGLE CHIP INSERIRE $00DD // $019B
> 46 A B609 CE1000        LDX          #$1000
> 47 A B60C 4F            CLRA
> 48 A B60D A72C          STAA          $2C,X
> 49 A B60F A709          STAA          $09,X
> 50 A                    *          STAA          $04,X ;AZZERA PORTB OUT
> 51 A B611 8607          LDAA          #$07
> 52 A B613 A708          STAA          $08,X
> 53 A B615 A728          STAA          $28,X
> 54 A B617 860C          LDAA          #$0C
> 55 A B619 A72D          STAA          $2D,X
> 56 A B61B 8610          LDAA          #$10
> 57 A B61D A72E          STAA          $2E,X
> 58 A B61F 8620          LDAA          #$20
;SETT
> BAUD RATE MIDI
>M68HC11 Absolute Assembler   Version 2.70C:MA03.ASC
>
>
> 59 A B621 A72B          STAA          $2B,X
> 60 A B623 9723          STAA          AR_DEL
> 61 A B625 970F          STAA          A_ARFLG
> 62 A B627 4A            DECA
> 63 A                    *          LDAA          #$1F
> 64 A B628 A707          STAA          $07,X          ;DIR
> PORTC 7- 3 INT...5 LED -0
> 65 A B62A 8693          LDAA          #$93
;ABILITA
> PSU ADC
> 66 A B62C A739          STAA          $39,X
> 67 A B62E 8632          LDAA          #$32
;SETTA ADC
> 68 A B630 A730          STAA          $30,X
> 69 A B632 CC05C0        LDD          #$05C0
> 70 A B635 DD0C          STD          A_MSB
> 71 A B637 8640          LDAA          #$40
> 72 A B639 A720          STAA          $20,X
> 73 A B63B A723          STAA          $23,X
> 74 A B63D A722          STAA          $22,X
> 75 A                    *          LDAA          #$FF
> 76 A                    *          STAA          RATE
> 77 A B63F 0E            CLI
> 78 A
> 79 A
> 80 A B640 18DE20        MAIN        LDY          RATE
> 81 A B643 1809          R1          DEY
> 82 A B645 26FC          BNE          R1
> 83 A B647 18DE20        LDY          RATE
> 84 A B64A 1809          R2          DEY
> 85 A B64C 26FC          BNE          R2
> 86 A                    *          LDX          #$1000
> 87 A B64E A603          LDAA          IPORTC,X
> 88 A B650 84E0          ANDA          #$E0
> 89 A B652 9109          CMPA          A_SW
> 90 A B654 2705          BEQ          M1
> 91 A B656 9709          STAA          A_SW

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> 92 A B658 BDB7E0      JSR      A_ANOFF
> 93 A B65B BDB732      M1      JSR      CONV
> 94 A B65E BDB667      JSR      AU_RG
> 95 A B661 BDB742      JSR      ELAB
> 96 A B664 7EB640      JMP      MAIN
> 97 A
> 98 A
> 99 A      ***** ROUTINES *****
> 100 A
> 101 A B667 A631      AU_RG    LDAA      $31,X
> 102 A B669 8120      CMPA      #$20
> 103 A B66B 231D      BLS       INCREM
> 104 A B66D A631      LDAA      $31,X
> 105 A B66F 81E0      CMPA      #$E0
> 106 A B671 2264      BHI       DECREM
> 107 A B673 86FF      LDAA      #$FF
> 108 A B675 9723      STAA      AR_DEL
> 109 A B677 960F      LDAA      A_ARFLG
> 110 A B679 2604      BNE      AU1
> 111 A B67B 861B      LDAA      #%00011011
> 112 A B67D A703      STAA      IPORTC,X
> 113 A B67F A631      AU1     LDAA      $31,X
> 114 A B681 39        RTS
> 115 A
> 116 A B682 18DE23    AR_DLY    LDY       AR_DEL
>M68HC11 Absolute Assembler Version 2.70C:MA03.ASC
>
>
> 117 A B685 1809      ARL      DEY
> 118 A B687 26FC      BNE      ARL
> 119 A B689 39        RTS
> 120 A
> 121 A B68A 861D      INCREM   LDAA      #%00011101
> 122 A B68C A703      STAA      IPORTC,X
> 123 A B68E 960F      LDAA      A_ARFLG
> 124 A B690 8110      CMPA      #$10
> 125 A B692 233F      BLS       I_RTN
> 126 A B694 861E      LDAA      #%00011110
> 127 A B696 A703      STAA      IPORTC,X
> 128 A B698 BDB7E0      JSR      A_ANOFF
> 129 A B69B 960E      INCR1    LDAA      A_AR
> 130 A B69D 8103      CMPA      #$03
> 131 A B69F 2304      BLS       INCR2
> 132 A B6A1 8620      LDAA      #$20
> 133 A B6A3 9723      STAA      AR_DEL
> 134 A B6A5 18DE0C    INCR2    LDY       A_MSB
> 135 A B6A8 1808      INY
> 136 A B6AA 188C0800   CPY       #$0800
> 137 A B6AE 2308      BLS       INCR3
> 138 A B6B0 18CE05C0   LDY       #$05C0
> 139 A B6B4 860C      LDAA      #%00001100
> 140 A B6B6 A703      STAA      IPORTC,X
> 141 A B6B8 18DF0C    INCR3    STY       A_MSB
> 142 A B6BB BDB682      JSR      AR_DLY
> 143 A B6BE B61031     LDAA      $1031
> 144 A B6C1 8150      CMPA      #$50
> 145 A B6C3 7C000E     INC       A_AR

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> 146 A B6C6 23D3          BLS      INCR1
> 147 A B6C8 7F000F        CLR      A_ARFLG
> 148 A B6CB 7F000E        CLR      A_AR
> 149 A B6CE 86FF          LDAA     #$FF
> 150 A B6D0 9723          STAA     AR_DEL
> 151 A B6D2 39             RTS
> 152 A B6D3 7C000F        I_RTN    INC      A_ARFLG
> 153 A B6D6 39             RTS
> 154 A
> 155 A B6D7 8617          DECRM    LDAA     #%00010111
> 156 A B6D9 B71003        STAA     PORTC
> 157 A B6DC 960F          LDAA     A_ARFLG
> 158 A B6DE 8110          CMPA     #$10
> 159 A B6E0 233E          BLS      D_RTN
> 160 A B6E2 860F          LDAA     #%00001111
> 161 A B6E4 A703          STAA     IPORTC,X
> 162 A B6E6 BDB7E0        JSR      A_ANOFF
> 163 A B6E9 960E          DECR1    LDAA     A_AR
> 164 A B6EB 8103          CMPA     #$03
> 165 A B6ED 2304          BLS      DECR2
> 166 A B6EF 8620          LDAA     #$20
> 167 A B6F1 9723          STAA     AR_DEL
> 168 A B6F3 18DE0C        DECR2    LDY      A_MSB
> 169 A B6F6 1809          DEY
> 170 A B6F8 188C03C0      CPY      #$03C0
> 171 A B6FC 2208          BHI      DECR3
> 172 A B6FE 18CE05C0      LDY      #$05C0
> 173 A B702 8606          LDAA     #%00000110
> 174 A B704 A703          STAA     IPORTC,X
>M68HC11 Absolute Assembler   Version 2.70C:MA03.ASC
>
>
> 175 A B706 18DF0C        DECR3    STY      A_MSB
> 176 A B709 BDB682        JSR      AR_DLY
> 177 A B70C A631          LDAA     $31,X
> 178 A B70E 81B0          CMPA     #$B0
> 179 A B710 7C000E        INC      A_AR
> 180 A B713 22D4          BHI      DECR1
> 181 A B715 7F000F        CLR      A_ARFLG
> 182 A B718 7F000E        CLR      A_AR
> 183 A B71B 86FF          LDAA     #$FF
> 184 A B71D 9723          STAA     AR_DEL
> 185 A B71F 39             RTS
> 186 A B720 7C000F        D_RTN    INC      A_ARFLG
> 187 A B723 39             RTS
> 188 A
> 189 A B724 DC0C          FTOV     LDD      A_MSB
> 190 A B726 F31018        ADDD     $1018
> 191 A B729 FD1018        STD      $1018
> 192 A B72C 8640          LDAA     #$40
> 193 A B72E B71023        STAA     $1023
> 194 A B731 3B            RTI
> 195 A B732
> 196 A B732 A632          CONV     LDAA     $32,X
> 197 A B734 2601          BNE      C1
> 198 A B736 4C            INCA
> 199 A B737 9720          C1      STAA     RATE

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```

> 200 A B739 4F          CLRA
> 201 A B73A E634        LDAB      $34,X
> 202 A B73C 05          LSLD
> 203 A B73D 05          LSLD
> 204 A B73E 05          LSLD
> 205 A B73F 9706        STAA      A_INT
> 206 A B741 39          RTS
> 207 A
> 208 A B742 1209204D    ELAB      BRSET      A_SW,#$20,E1
;TESTA
> A1/B1 ? MIDI ON/OFF
> 209 A B746 A631        LDAA      $31,X
> 210 A B748 44          LSRA
> 211 A B749 44          LSRA
> 212 A B74A 9722        STAA      TEMP
> 213 A B74C 12098006    BRSET      A_SW,#$80,E0
;TESTA
> SW A3/B3 ? SCALA 12/M
> 214 A B750 BDB794      JSR      SCALA
> 215 A B753 CE1000      LDX      #$1000
> 216 A B756 9102        CMPA      A_NT1
> 217 A B758 2739        BEQ      E1
> 218 A B75A 9103        CMPA      A_NT2
> 219 A B75C 2735        BEQ      E1
> 220 A B75E 9700        STAA      A_NTON
> 221 A                  *
> 222 A B760 9606        LDAA      A_INT
> 223 A B762 270D        BEQ      EEE
> 224 A B764 9600        EE0      LDAA      A_NTON
> 225 A B766 9001        SUBA      A_NTOFF
> 226 A B768 8130        CMPA      #$30
> 227 A B76A 2301        BLS      EE1
> 228 A B76C 43          COMA
> 229 A B76D 9106        EE1      CMPA      A_INT
> 230 A B76F 2F22        BLE      E1
> 231 A                  *
> 232 A B771 9600        EE0      LDAA      A_NTON
>M68HC11 Absolute Assembler Version 2.70C:MA03.ASC
>
>
> 233 A B773 16          TAB
> 234 A B774 BDB7B8      JSR      N_ON
> 235 A B777 D601        LDAB      A_NTOFF
> 236 A B779 BDB7CD      JSR      N_OFF
> 237 A B77C
> 9603                  LDAA      A_NT2      ;AGGIORNA CODA
NOTE
> 238 A B77E 9701        STAA      A_NTOFF
> 239 A B780 9602        LDAA      A_NT1
> 240 A B782 9703        STAA      A_NT2
> 241 A B784 9600        LDAA      A_NTON
> 242 A B786 9702        STAA      A_NT1
> 243 A B788 13094007    BRCLR      A_SW,#$40,E1
;TESTA
> SW A2/B2 ? 1/3 NOTE
> 244 A B78C 9600        LDAA      A_NTON
> 245 A B78E 9701        STAA      A_NTOFF

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> 246 A B790 7F000F      CLR      A_ARFLG
> 247 A B793 39          E1      RTS
> 248 A B794
> 249 A B794 4F          SCALA    CLRA
;ATTN
> USA REGISTRI D, X, Y
> 250 A                  *      PSHX
> 251 A B795 D622        LDAB     TEMP
> 252 A B797 CE000C      LDX      #$000C
> 253 A B79A 02          IDIV
> 254 A B79B 18CEB7F4    LDY      #TABLE
> 255 A B79F 183A        ABY
> 256 A B7A1 50          NEGB
> 257 A B7A2 DB22        ADDB     TEMP
> 258 A B7A4 18EB00      ADDB     $00,Y
> 259 A B7A7 17          TBA
> 260 A                  *      PULX
> 261 A B7A8 39          RTS
> 262 A
> 263 A B7A9
> B7102F      TX_A      STAA      $102F      ;TRASMETTE VAL
> CONTENUTO IN A
> 264 A B7AC
> 18CE1000      LDY      #$1000      ;RITARDO  MS
????
> 265 A B7B0 1809      T1      DEY
> 266 A B7B2 26FC      BNE      T1
> 267 A B7B4
> B6102E      LDAA      $102E      ;PREDISPONE
> NUOVAMENTE LA SERIALE
> 268 A B7B7 39          RTS
> 269 A
> 270 A B7B8 B6102E      N_ON     LDAA      $102E
;PREPARA
> LA SERIALE * INPUT REG B
> 271 A B7BB 8690      LDAA      #$90
> 272 A B7BD BDB7A9      JSR      TX_A
> 273 A B7C0 17          TBA
> 274 A B7C1 8B28      ADDA      #$28
> 275 A B7C3 BDB7A9      JSR      TX_A
> 276 A B7C6 A633      LDAA      $33,X
> 277 A B7C8 44          LSRA
> 278 A B7C9 BDB7A9      JSR      TX_A
> 279 A B7CC 39          RTS
> 280 A
> 281 A B7CD B6102E      N_OFF    LDAA      $102E
;PREPARA
> LA SERIALE * INPUT REG B
> 282 A B7D0 8690      LDAA      #$90
> 283 A B7D2 BDB7A9      JSR      TX_A
> 284 A B7D5 17          TBA
> 285 A B7D6 8B28      ADDA      #$28
> 286 A B7D8 BDB7A9      JSR      TX_A
> 287 A B7DB 4F          CLRA
> 288 A B7DC BDB7A9      JSR      TX_A
> 289 A B7DF 39          RTS
> 290 A

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>M68HC11 Absolute Assembler Version 2.70C:MA03.ASC

>

>

> 291 A B7E0

> B6102E A ANOFF LDAA \$102E

;TRASMETTE

> ALL NOTES_OFF SUL MIDI CH 0

> 292 A B7E3 86B0 LDAA #\$B0

> 293 A B7E5 BDB7A9 JSR TX_A

> 294 A B7E8 867B LDAA #\$7B

> 295 A B7EA BDB7A9 JSR TX_A

> 296 A B7ED 8600 LDAA #\$00

> 297 A B7EF BDB7A9 JSR TX_A

> 298 A B7F2 39 RTS

> 299 A

> 300 A END

>SYMBOL TABLE: Total Entries= 52

>

>ARL B685 E1 B793

>AR_DEL 0023 EE0 B764

>AR_DLY B682 EE1 B76D

>AUI B67F EEE B771

>AU_RG B667 ELAB B742

>A_ADC 0007 FTOV B724

>A_ANOFF B7E0 INCR1 B69B

>A_AR 000E INCR2 B6A5

>A_ARFLG 000F INCR3 B6B8

>A_INT 0006 INCREM B68A

>A_LSB 000D INIT B600

>A_MSB 000C IPORTC 0003

>A_NT1 0002 I_RTN B6D3

>A_NT2 0003 M1 B65B

>A_NTOFF 0001 MAIN B640

>A_NTON 0000 N_OFF B7CD

>A_SW 0009 N_ON B7B8

>A_VEL 0005 PORTC 1003

>C1 B737 R1 B643

>CONV B732 R2 B64A

>DECR1 B6E9 RATE 0020

>DECR2 B6F3 SCALA B794

>DECR3 B706 T1 B7B0

>DECREM B6D7 TABLE B7F4

>D_RTN B720 TEMP 0022

>E0 B756 TX_A B7A9

>

>Total errors: 0